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Proposed subjects for thesis on *CO_2 - flooding*

Injection of carbon dioxide (CO_2) to oil reservoirs has the potential to increase the recovery. Important recovery mechanisms in CO_2-flooding are oil swelling, reduction of oil viscosity and phase transitions (which can potentially develop miscible displacement). Efficient transport of CO_2 to remaining oil and efficient transport of mobilised oil to the producers, are necessary to obtain high oil recovery. Poor macroscopic sweep efficiency has been reported to be a problem in many CO_2 floods. The oil production can be stimulated by improving macroscopic sweep efficiency. Improved macroscopic sweep will also delay the CO_2 breakthrough, reduce the CO_2 production and increase the CO_2 storage capacity for oil reservoirs. Chemicals can be used to reduce the mobility of CO_2, e.g. CO_2-foam and CO_2-polymer.

Proposed subjects:

Improvement of macroscopic sweep in CO_2 - flooding

1. Effects of chemicals on CO_2 diffusion in fractured reservoirs

Diffusion of CO_2 from fractures into matrix blocks can be an important transport mechanism in CO_2-flooding of fractured oil reservoirs. The diffusion rate for CO_2 should not be reduced by chemicals added to improve macroscopic sweep efficiency. Diffusion of CO_2 will be studied in simplified fractured reservoir models with and without chemicals.

One student can work on this subject.

2. Viscous flooding of CO_2-foam and CO_2-polymer in fractured reservoirs

Viscous flooding can give an important contribution to transport of fluids in fractured reservoirs. Transport of CO_2 and chemicals will be studied by viscous flooding of CO_2-foam and CO_2-polymer systems in simplified fractured reservoir models.

One student can work on this subject.

3. Retention of CO_2-foaming agents

Cost efficiency for CO_2-foam processes strongly depends on retention of foaming agents. Adsorptions of foaming agents onto rocks will be determined at different conditions. The potential for sacrificial agents (cheaper chemical products) to reduce adsorption of foaming agents will also be evaluated. For promising foaming agents thermal stability will be determined.

Two students can work on this subject.

4. Transport of CO_2 in fractured reservoirs

In fractured oil reservoirs, transport of CO_2 from fractures into matrix is important. Mechanistic simulations using the reservoir simulator STARS, will be carried out to study transport of CO_2 during pure CO_2 flooding and CO_2-foam. The influence of capillary pressure and initial water saturation will be investigated.

One student can work on this subject.

CO_2 – flooding mechanism

5. Effects of wettability on CO_2-transport in fractured reservoirs

The effects of wettability on CO_2-transport in fractured reservoirs will be studied using the compositional reservoir simulation model Eclipse 300. The initial wettability conditions will be varied.

One student can work on this subject.

6. Spontaneous imbibition of carbonated water in fractured reservoirs

During co-injection and alternating injection of CO_2 and water, water will become saturated with CO_2. This carbonated water will be transported as a water-phase in the reservoir. Spontaneous imbibition of carbonated waters will be studied.

One student can work on this subject.

7. Reduction of oil viscosity by CO_2 (only bachelor thesis)

In immiscible CO_2-flooding reduction of oil viscosity can be an important oil recovery mechanism. The potential for immiscible CO_2-flooding of oil reservoirs on the Norwegian Continental Shelf will be evaluated.

One student can work on this subject.